

17. Discuss the inference rules of propositional calculus.
18. Explain the permutations with repetitions. Give an example.
19. Verify Cayley — Hamilton theorem to find A^4 and A^{-1} when $A = \begin{bmatrix} -2 & -1 & -2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.
20. Prove that a connected graph G is an Euler graph if and only if every vertex of G .
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NOVEMBER/DECEMBER 2023

23PCA11 — DISCRETE MATHEMATICS

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. What is the binary relation?
2. Write the formula for equivalence relation.
3. Define well-formed formula.
4. Give an example of universal identifier.
5. What is recursive relation?
6. Give an example of permutation.
7. How to find the root of a matrix?
8. What is inverse of square matrix? Give an example.
9. What is the formula of hypercube graph?
10. How is bipartite graph represented?



SECTION B — (5 × 5 = 25 marks)

Answer ALL the questions.

11. (a) Let A be the set $\{1, 2, 3, 4\}$. Which ordered pairs are in the relation $R = \{(a, b) \mid a \text{ divides } b\}$?

Or

- (b) Let $A = \{a_1, a_2, a_3\}$ and $B = \{b_1, b_2, b_3, b_4, b_5\}$. Which ordered pairs are in relation R represented by the matrix :

$$M_R = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix} \text{ is } R \text{ reflexive, symmetric,}$$

and/or antisymmetric?

12. (a) For each of the following logical statements, find the truth value and from that information find the logically equivalent disjunctive normal form.

(i) $\sim[(\sim p \rightarrow q) \rightarrow r]$

(ii) $P \rightarrow (q \wedge r)$

(iii) $(p \wedge r) \leftrightarrow (\sim q \vee r)$

Or

- (b) Construct the truth table for the following:

$$(P \vee Q) \rightarrow ((P \vee R) \rightarrow (R \vee Q))$$

13. (a) Solve the recurrence $t_n = 3t_{n-1}, n \geq 1$ with initial condition $t_0 = 5$.

Or

- (b) Write the procedure for solving non-homogeneous recurrences.

14. (a) What are the properties of rank of a matrix? Explain.

Or

- (b) Describe the Cramer's rule.

15. (a) Explain the Hamiltonian circuit and path with an example.

Or

- (b) Explain the incidence matrix with an example.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Let R be a relation defined on the set $A = \{-2, -1, 0, 1, 2, 3, 4\}$ $m, n \in A, m R n \Leftrightarrow n = m^2$

- (a) What are the ordered pairs in the relation R ?
 (b) Find the domain and the image of R ?
 (c) Represent R by the digraph?

